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Space-time characteristics of areal reduction factors and precipitation mechanisms

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We link areal reduction factors (ARFs, the ratio of annual maxima catchment precipitation and point precipitation) to the dominating precipitation mechanisms in Austria (84,000km²), using a new efficient method of estimating ARFs based on block kriging. A better understanding of the precipitation mechanisms help assess the plausibility of the ARFs estimated, but ARFs likewise contribute to a better understanding of the precipitation mechanisms as they are a fingerprint of the spatial statistical behavior of extreme precipitation. Our main focus is on two sub-regions in the West and East of Austria, dominated by stratiform and convective precipitation, respectively. ARFs are estimated using rain gauge data with hourly resolution across five durations. ARFs decay faster with increasing area in regions of pronounced convective activity than in regions dominated by stratiform processes. Low ARF values are linked to increased lightening activity (as a proxy for convective activity), but low ARFs can likewise occur in areas of reduced lightning activity as, in summer, convective precipitation can occur everywhere in the country. ARFs tend to decrease with increasing return period, possibly because the contribution of convective precipitation is higher. Our analysis is a key component towards a better understanding of the hydrometeorology in the region, as the process links of the ARFs relate to the space-time scaling of floods.